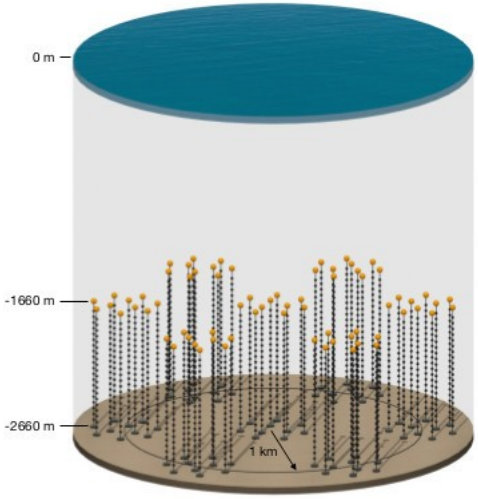
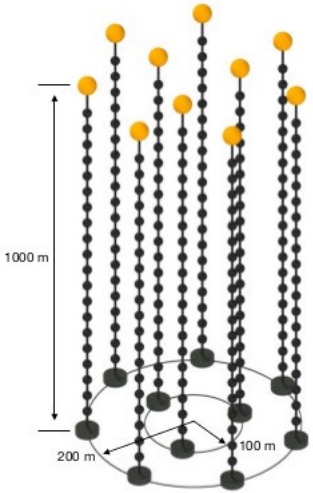
P-ONE: The Pacific Ocean Neutrino Experiment





P-ONE @ P5

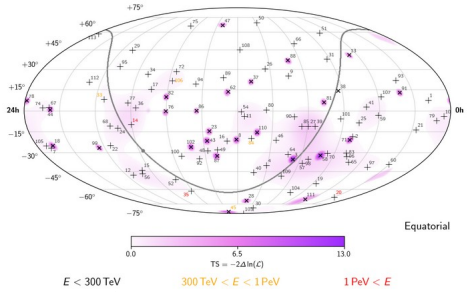
Nathan Whitehorn
Michigan State University
22 March, 2023

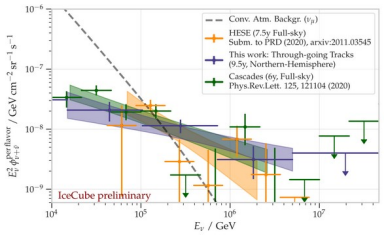
P-ONE

Project Goals: Precision Astrophysical Neutrinos

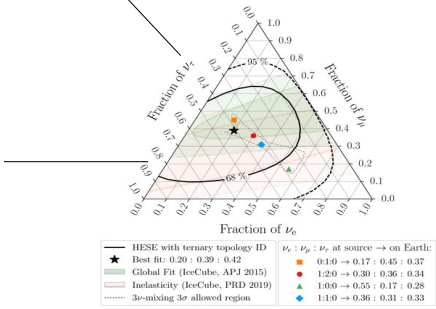
- IceCube sees a **bright, near-isotropic** astrophysical neutrino background at 10-8000 TeV – thousands a year – of unknown origin
- Powerful probe of **extreme astrophysical environments** as well as **neutrino physics on ultra-long (gigaparsec) baselines**
- Moving from discovery to understanding will require **statistics** and **precision**
- **Optimize for point sources + flavor:** dark matter, non-standard interactions, HE astrophysics

Source ID



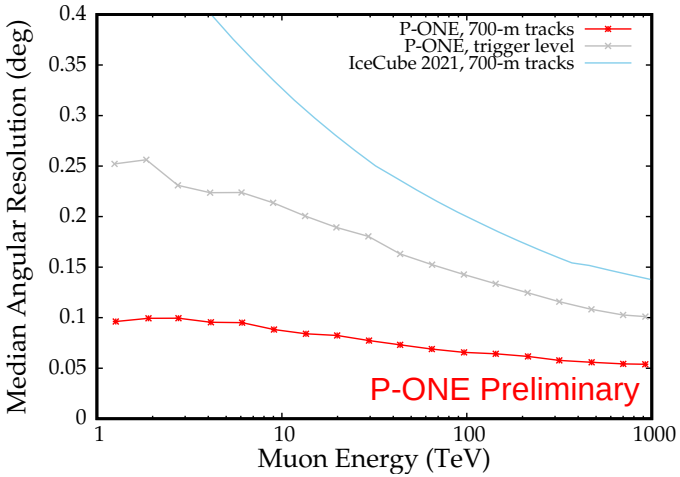


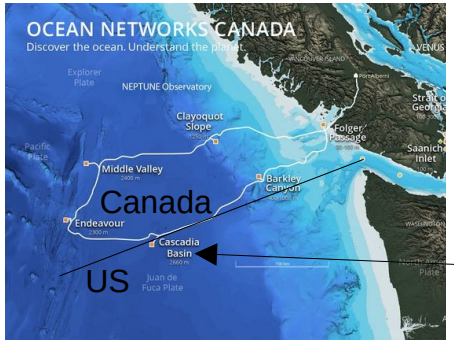
Spectrum

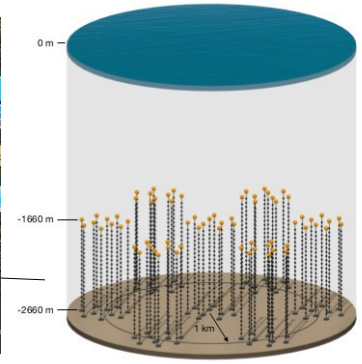


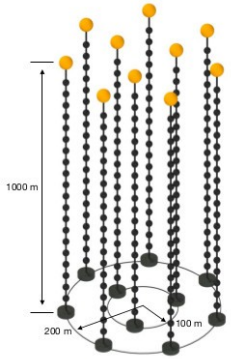
Flavor

The P-ONE Detector







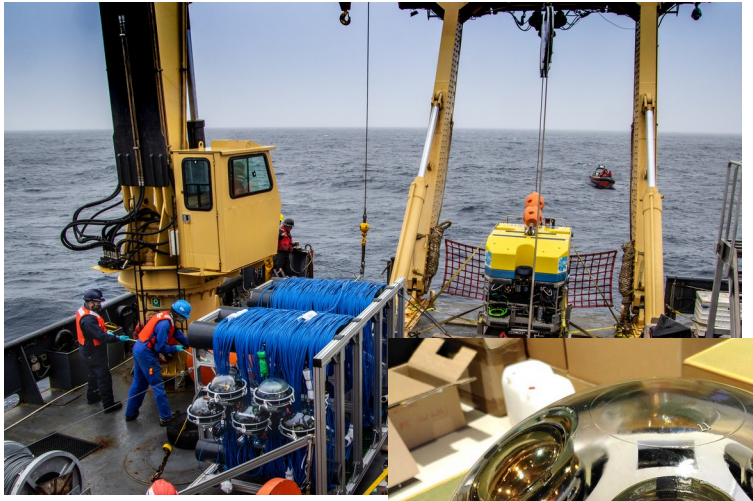


- **km³ volume**, with **complementary** field of view to IceCube from North
- Much-reduced optical scattering: 5x better angular resolution, 5x better sensitivity, **10x more sources**
- **Per-source** flavors and improved tau ID
- Utilizes **existing deep-sea infrastructure from Ocean Networks Canada**
- **Modular, scalable design** with **electronics and analysis led by US**
- US, Canada, Germany, Poland, UK collaboration

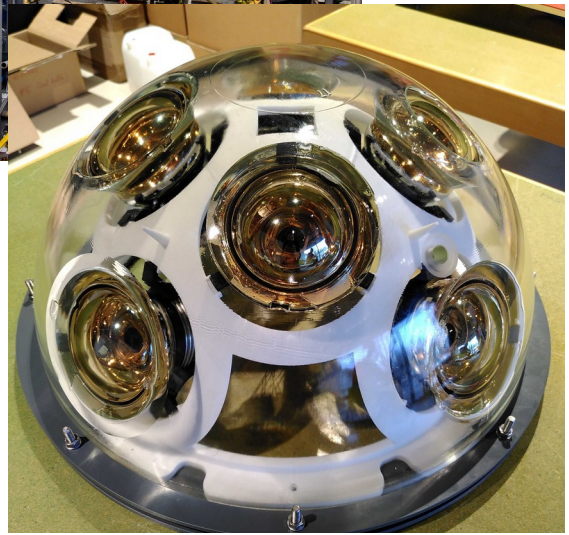
Project Status and Timeline

- **2018-present:** Prototype site-validation instruments (STRAW + STRAW-B) operating
- **2020-2022:** Conceptual design and cable/infrastructure technical design
- **2021-2023:** Module technical design
- **2024:** Deployment of first line (P-ONE-1) with German, Canadian and US (MSU, Georgia Tech, Drexel) institutional funds
- **2025**: Additional three lines (ERC)

- **Late 2020s:** Full detector construction (led by planned NSF mid-scale)



STRAW-B Deploy-ment, 2020



P-ONE Optical Module in Integration Testing, late 2022